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MPB PHEROMONE TRIALS IN COLORADO 1985

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MPB PHEROMONE TRIALS IN COLORADO - 1985

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ABSTRACT

Our objective was to concentrate mountain pine beetle attacks into cut blocks by baiting them with pheromones, subsequently destroying the beetles by clearcut harvesting and processing, effecting beetle suppression in selected treatment areas. While we did increase the trees attacked per acre in the baited areas we cannot say we lowered the population.

INTRODUCTION

Attraction and aggreation of mountain pine beetle (MPB), Dendroctonus ponderosae Hopkins in lodgepole pine, Pinus contorta var latifolia Englemann by baiting trees with pheromones have produced encouraging results for suppression of MPB populations in British Columbia (Borden, 1986; DeBoo, 1985; Hall, 1986, [unpublished report]; Alberta [Miyagawa, unpublished report]; and Montana [Gibson, unpublished report]). These reports attracted the attention of forest managers in Colorado involved in forest management of MPB infested lodgepole pine.

Early in 1985, agency members of the High Country Integrated Pest Management Project, (USDA Forest Service [USFS], USDI Bureau of Land Management [BLM] and the Colorado State Forest Service [CSFS]), decided to conduct pheromone baiting trials for control of MPB in conjunction with sanitation and silvicultural practices in lodgepole pine. Criteria and implementation guidelines for field personnel of the various agencies to use for evaluation of the pheromone trials were prepared by pest management personnel of CSFS and USFS R-2. Semiochemical baits "MPB Lures" obtained from Phero Tech, Inc., were used for the baiting trials. The "MPB Lures" contain the aggregation pheromones trans-verbenol and exo-brevicomin, and the host tree kairomone, myrcene.

METHODS AND MATERIALS

Thirteen (13) bait areas (cut blocks) were established within the High Country Project. The bait areas were selected and established on USFS lands of the White River and Arapaho National Forests, Bureau of Land Management, and on private lands. The Colorado State Forest Service was the responsible agency for those on private holdings. Table 1 lists the bait areas, responsible agency, and pertinent information for each test site.

All bait areas were selected within current (1984 beetle attacked) infestation areas. The cut blocks were then delineated and scheduled for clearcut harvest following the 1985 MPB mass attack period and attainment of post-treatment data. To evaluate the MPB infestation of the area surrounding the cut blocks, strip survey lines (probe lines) were established. The probe lines were 1 chain wide and 80 chains long where terrain and lodgepole type permitted. There were 4 probe lines radiating out from the cut blocks except at two areas where there were 5 probe lines.

The probe lines compass bearings were about 90 degrees apart, but the bearings of some lines were biased when necessary to best transect lodgepole type. Using the selected bearing, centerline trees were marked with paint to control pre- and post- searches of the 1 chain wide strip (probe line).

To determine the effect of treatment, trees per acre attacked by MPB were compared between the years of 1984 and 1985 in the bait areas to the surrounding areas up to 80 chains distance. The surrounding area was compared to the baited areas by four distance intervals: (1) 0 to 10 chains, (2) 10 to 20 chains, (3) 20 to 40 chains, and (4) 40 to 80 chains (Figure 1).

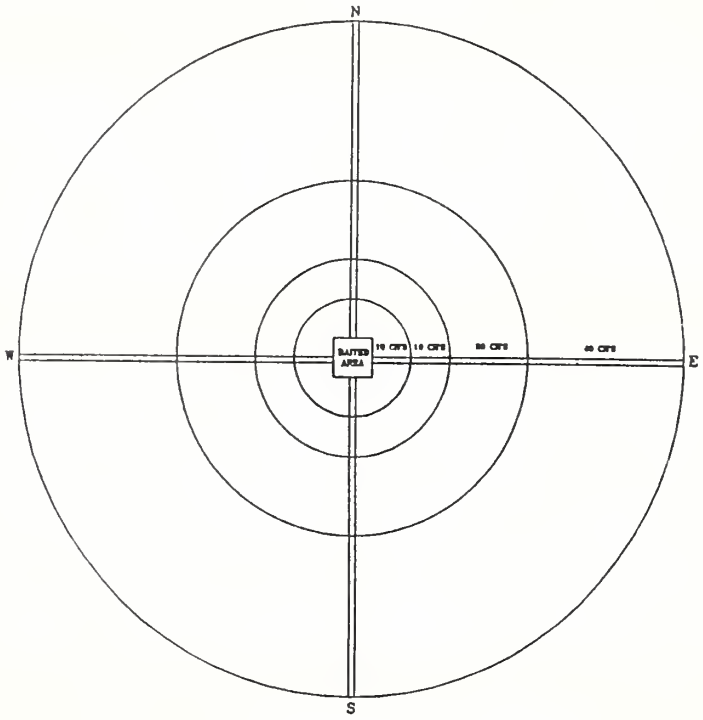

Figure 1. Schematic of bait area, probe line survey layout and portrayal of distance concentric area intervals from the baited area nucleus.

The Wilcoxon Matched-Pairs Signed Test was used to determine significances of difference of the attacked trees per acre for the years of 1984 and 1985 of the bait areas and the surrounding area. Wald-Wolfowitz Runs Test and Spearman Correlation Coefficient Tests were used to determine the significance of basal area, average age, trees per acre, average dbh, elevation and risk rating on MPB trees per acre for 1984-1985.

Pre-treatment: A variable plot survey was conducted in each bait area and the probe lines to estimate the lodgepole pine stocking, basal area, age, and diameter at breast height (DBH). Prior to the 1985 MPB flight period, each bait area and probe line set were searched thoroughly for the current MPB hits. The current hits, based on the presence of frass or pitch tubes or both were marked with paint and tallied. Counts were tallied by 2 chain intervals along the probe lines and a cumulative total for cut blocks (bait areas).

Table 1. Bait areas by name, responsible agency for field implementation, and pertinent information for each area.

Area name	Agency	elev (feet)	size (acres)	total # baits	bait spacing (feet)	# probe lines
Williams Fork	CSFS	8800	11.7	57	90	4
Stillwater	CSFS USFS	8700	7	34	95	4
Green Mtn. #1	CSFS	8900	6.4	14	140	4
Green Mtn. #2	CSFS	8900	3	19	80	4
Green Mtn. #3	CSFS	8900	.7	14	50	4
Stone Creek	CSFS USFS	10000	10	63	80	5
Strawberry	BLM	9400	9	69	75	4
Meadow Creek	USFS	9300	9	47	90	4
Frey Gulch	USFS	10200	4	50	60	4
Ophir Mtn.	USFS	9800	3	50	50	4
Hardscrabble	USFS	9400	10	100	66	5
Chapman Gulch	USFS	9400	10	100	66	4
Tigiwon	USFS	9400	10	100	66	4

The pheromone bait ("MPB lures") placement was completed by July 10, 1985 prior to MPB emergence and flight. The baits were attached to susceptible trees on the north face. Bait placement within the cut blocks was on a grid basis in each area; the grid spacing was uniform within an area, but did vary by area, ranging from 50 feet to 140 feet (Table 1).

Post-treatment: After September 15, 1985, when mass attacking had ceased, the post-treatment data was obtained. All bait areas and probe lines were again searched to find and count the 1985 new hits on green trees. No attempt was made to quantify the new hits in terms of mass attacked or a critical attack density of 40 attacks/M^2 to cause death of the attacked tree, as described by Raffa and Berryman (1983).

The bait areas were hazard rated to evaluate their susceptibility to beetle epidemic using the guidelines of Amman et al. (1977).

RESULTS AND DISCUSSION

Trees per acre attacked by MPB in 1985 increased from 1984 in 10 of the 13 baited areas. In the surrounding area sampled by probe lines, MPB attacked trees per acre decreased at 11 of the sites and 2 were static (Table 2). There were significantly more hits per acre in the bait areas in 1985 (Z=2.6557) and in probe lines in 1984 (Z=3.1809). Analysis of the attacks per acre by the four distance intervals (0-10 ch, 10-20 ch, 20-40 ch, and 40-80 ch) between the years of 1984 and 1985 did not demonstrate significant differences between years or distance interval.

Of the 13 bait area stands, 6 were rated as high hazard and 7 were moderate. Wald-Wolfowitz Runs Test was used to test hazard class to trees per acre attacked for 1984 and 1985. Beetle attacks were not significantly different by hazard class.

Table 2. Summary of 1984-1985 MPB attacks per acre of baited vs. unbaited areas.

	1984 MPB hits/acre		1985 MPB hits/acre	
Area name	baited area	surrounding area	baited area	surrounding area
Williams Fork	3.8	4.9	12.0	1.3
Stillwater	4.9	9.1	8.3	2.2
Green Mtn. #1	3.3	1.4	9.0	0.3
Green Mtn. #2	10.7	0.3	20.0	0
Green Mtn. #3	18.6	0.8	37.1	0.6
Stone Creek	0.2	0	0	0
Strawberry	3.4	4.9	15.0	1.1
Meadow Creek	11.6	4.8	15.0	1.7
Frey Gulch	0	.4	0.5	0.1
Ophir Mtn.	0	1.5	11.3	0.1
Hardscrabble	7.9	2.2	1.7	0.3
Chapman Gulch	0.3	3.8	6.6	1.1
Tigiwon	11.0	3.8	4.5	1.6

Comparisons of other stand factors to attacked trees per acre were average age, basal area, green trees per acre, average dbh, and elevation. Of those, only elevation was found to have significant correlation to beetle population in both years 1984 (-.5835) and 1985 (-.5878) (Table 3). This correlation confirms the normal expectation of a decrease in beetle populations as elevation increases.

Table 3. Matrix Displaying the correlation values of stand factors: stand age (AGE), basal area (BA), green trees per acre (TPA), average dbh (DBH), and elevation (ELEV) to trees attacked by MPB in 1984 (MP84) and 1985 (MP 85).

SPEARMAN CORRELATION COEFFICIENT

	AGE	BA	TPA	DBH	ELEV
MPB84	-.0413	.0964	.0634	.1364	-.5835
	N (13)	N (13)	N (13)	N (13)	N (13)
	SIG .447	SIG .377	SIG .419	SIG .328	SIG .018
MPB85	.1486	.5455	.2231	.2672	-.5878
	N (13)	N (13)	N (13)	N (13)	N (13)
	SIG .314	SIG .027	SIG .232	SIG .189	SIG .017

Ratios of the mean attack rate (attacks per acre) in baited and non-baited surrounding areas (Table 4) indicate an increase with the use of "MPB Lure", even though the general trend of MPB populations in the High Country Project area was declining (Lessard, 1985).

Table 4. Mountain Pine Beetle Attack Ratios 1985 to 1984

Bait areas	2.17:1
Probe lines	.28:1
High Country Project area	.47:1

Even though there were significant differences in the attack rate between bait areas and probe lines, we could not find a significant correlation between the probe line intervals of 10, 20, 40 and 80 chains.

The lack of significance between the distance intervals analyzed leads us to believe the primary effect was mostly containment of the beetle population to the baited areas with some minor shift being probable. Observationally, we noted, there were few trees which were mass attacked sufficient to kill them; whereas, the incidence of trees with pitchout attacks were common.

Unfortunately, we did not take data to quantify the two density types of tree attacks. Failure to identify a dramatic shift of MPB infestations with the use of mass baiting is similar to the findings reported by Borden, et al. (1986), where a partial shift was noted up to approximately 100 meters, and beyond 200 meters the infestations continued undisturbed by the mass baiting program.

"MPB Lure" used on lodgepole pine is effective in attracting beetles to individual trees. Based on the data in these trials, MPB populations can be held in place with grid baiting of areas. Our objective was to effect beetle suppression in selected areas. Our data suggests limited suppression of MPB populations can be effected, assuming there is timely harvest and processing of the baited area material, even though the general population did also decline.

We did not attempt to demonstrate economic efficiencies, measure population densities, or the level of suppression needed by forest land managers. We believe these are important issues which should be investigated and better defined before operational use.

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